ASTRONOMERS MAP ACTION IN THE COSMIC SUBURBS

A group of Hawaii and California astronomers led by Dr. Roy Gal of the University of Hawaii at Manoa and Dr. Lori Lubin of the University of California at Davis is announcing today at the American Astronomical Society meeting in Honolulu, Hawaii, that they have, for the first time, mapped where the “action” is in a mega-structure in the distant universe.

Large galaxy clusters are typically considered the universe’s metropolises, and for years many astronomers have focused their attention “downtown.” However, this research shows that all the action is actually happening in the galactic suburbs.

“The most interesting thing that we’ve found so far is the incredible amount of activity occurring in galactic suburbia,” says Lubin, who is the principal investigator of the Observations of Redshift Evolution in Large Scale Environments (ORELSE) Survey. “We see unusually large numbers of galaxies with high star formation rates, producing over 100 new suns per year, and with active central supermassive black holes.”

ORELSE is one of the first comprehensive surveys of large-scale environments around very massive galaxy clusters between 6 and 9 billion light-years away. In this study, Lubin and her collaborators hope to gain insights into physical properties that affect galaxies in the cluster outskirts and understand the interactions that leave them forever changed.

Like grapes, the universe’s galaxies come in clusters, and those clusters typically bunch together to form even more massive structures, or superclusters. Scientists refer to the large clusters at the heart of a supercluster as the Los Angeleses, New Yorks or Londons. Much like freeways connect big cities to smaller towns, a web of galaxies connects these large clusters to smaller groups of galaxies.

In the past, telescope limitations forced astronomers to focus their studies on either the centers of large clusters or random regions in the cosmic web. Now, with the latest ground-based and space-based telescopes, scientists are able to map larger areas. “Our research is like mapping the whole Big Island of Hawaii instead of just the town Hilo,” says Gal, who is a co-investigator of the study. “We have already discovered the largest known supercluster—cluster of clusters—present when the universe was half its current age.”

To see what is happening in the cluster suburbs, the team collected data with nine different telescopes, including the 10-meter Keck I and II telescopes, the 8-meter Subaru telescope and the 4-meter United Kingdom Infrared Telescope on Mauna Kea, Hawaii; the 5-meter Palomar telescope in California; the 4-meter Kitt Peak telescope in Arizona; and the Very Large Array in New Mexico. For space-based observations, the team used three of NASA's Great Observatories: the Spitzer and Hubble space telescopes, and the Chandra X-ray Observatory.

“The Spitzer observations interest me. With Spitzer, we expect to discover even more galaxies containing voracious black holes. They may be hidden behind thick curtains of dust, but Spitzer will find them,” says Dr. Gordon Squires, of the Spitzer Science Center, Pasadena, CA, another co-investigator.

Team members also note that this study may provide valuable clues about our Milky Way galaxy’s future. They say that our Milky Way is currently sitting in galactic suburbia and that our nearest cosmic metropolis is the Virgo Cluster of galaxies, located approximately 100 million light-years away.
The collaboration also includes Dr. Mark Lacy and Dr. Jason Surace at the Spitzer Science Center, Dr. Neal Miller at Johns Hopkins University, Baltimore, and Dr. Christopher Fassnacht, Dr. Dale Kocevski, and graduate student Brian Lemaux at the University of California, Davis. Surace (1998) and Kocevski (2006) received their doctorates from UH Manoa.

The title of the paper being given at the AAS meeting is “A Complex Supercluster at $z = 0.9$: Multiwavelength Observations of Cl1604,” by Roy R. Gal, L. M. Lubin, G. K. Squires, B. Lemaux, D. Kocevski, N. Miller, and C. Fassnacht.

The Institute for Astronomy at the University of Hawaii conducts research into galaxies, cosmology, stars, planets, and the sun. Its faculty and staff are also involved in astronomy education, deep space missions, and in the development and management of the observatories on Haleakala and Mauna Kea.

Established in 1907 and fully accredited by the Western Association of Schools and Colleges, the University of Hawaii is the state’s sole public system of higher education. The UH System provides an array of undergraduate, graduate, and professional degrees and community programs on 10 campuses and through educational, training, and research centers across the state. UH enrolls more than 50,000 students from Hawaii, the U.S. mainland, and around the world.


Caption: Multiple views of a supercluster seen when the universe was half its present age show a diversity of structure. Large clusters (cities), consisting mainly of red galaxies, are connected by filaments and smaller groups (highways and suburbs) with a higher fraction of younger, blue galaxies. Galaxies with supermassive black holes, shown in yellow, tend to avoid the cluster centers, while many radio sources (green) are clustered similar to normal galaxies. The inset shows a Hubble Space Telescope image of one of the clusters, with confirmed members circled.